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Finnish Forest Research Institute

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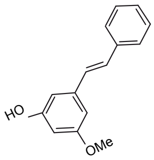
Selective seed harvest in seed orchards

Harju, A.M.[1], Partanen, J.[2] Venäläinen, M.[1] and Kärkkäinen, K.[3]

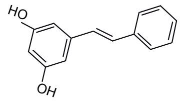
Seed harvest from selected seed orchard clones would hasten the production of seedlings having an inherited ability to produce durable heartwood when grown up.

The heartwood of Scots pine offers moderately durable and environmentally friendly material for wood products. The durability is due to extractives, which accumulate into heartwood during its formation. Especially, the concentration of stilbenes pinosylvin (PS) and its monomethyl ether (PSM) is strongly related to the decay resistance of Scots pine heartwood timber.



Natural stand

Measurement of stilbenes provides an indirect tool to predict decay resistance. Individual trees differ greatly from each other in the concentration of stilbenes in their heartwood. Great proportion of the measured variation is strongly inherited. Large genetic variation and high heritability of the stilbene concentration promise high genetic gain from selection.



Progeny trial

Seed collection — Cloning by grafting

Seed orchard

Breeding for heartwood traits is slow due to their late expression age. At present, most of the progeny trials are too young for the heartwood studies. However, grafts in first generation seed orchards are already producing heartwood. We studied 1) the heritable variation in the content of stilbenes in the heartwood of grafted clones, and 2) compared the genetic variation found in grafted clones with the variation found in their progenies.

Half-sib progenies growing in a field trial and their grafted mothers in seed orchards were surveyed for several chemical and dimensional heartwood characteristics.

$0 < h^2 < 1,\ 0 < CV_A$ the higher, the better $0 < H^2 < 1 < 100,\ 0 < CV_C < 100$

Table 1. Estimates of the genetic parameters for the concentration of heartwood extractives and heartwood properties of 53 families of Pinus sylvestris from a progeny trial.

	n	Mean	h^2	CV_A, %
Pinosylvin, PS (mg/g)	503	4.0	0.67	35
Pinosylvin monomethyl ether, PSM (mg/g)	503	6.9	0.72	34
Total phenolics (mg TAE/g)	497	8.7	0.52	26
Density, heartwood sample (mg/cm3)	494	382	0.58	7
Number of heartwood annual rings	503	10.5	0.35	11
Heartwood radius (mm)	503	44.4	0.34	12
Proportion of heartwood in cross-cut area (%)	502	16.9	0.16	13

Note: *n* = number of trees sampled, h^2 = narrow-sense heritability, CV_A = coefficient of the additive genetic variation.

Table 2. Estimates of the genetic parameters for the concentration of heartwood extractives and heartwood properties of 17 clones of Pinus sylvestris from seed orchards 154 and 201.

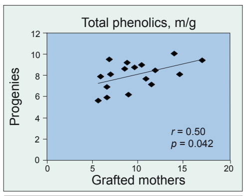
	n	Mean	H^2	CV_C, %
Pinosylvin, PS (mg/g)	187	2.8	0.81	49
Pinosylvin monomethyl ether, PSM (mg/g)	187	4.6	0.72	40
Total phenolics (mg TAE/g)	187	9.4	0.74	34
Density, heartwood sample (mg/cm3)	187	391	0.50	8
Number of heartwood annual rings	187	13.0	0.19	7
Heartwood radius (mm)	187	55.8	0.33	13
Proportion of heartwood in cross-cut area (%)	187	20.4	0.40	22

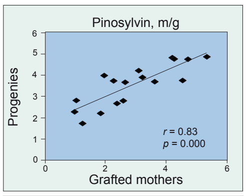
Note: *n* = number of grafts sampled, H^2 = broad-sense heritability, CV_C = coefficient of variation in clonal means.

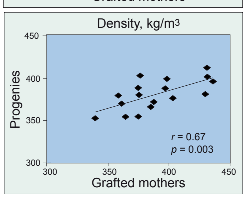
Results

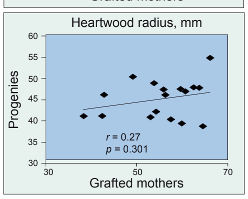
High and statistically significant positive correlations were found between the grafted mothers and their progenies growing in the progeny trial. The correlations were clearly higher for chemical traits and density than for the dimension traits.

The grafted mother clones with a high or low concentration of measured extractives could be clearly identified.









Conclusions

The selective harvest of Scots pine seed from seed orchards is a promising way to obtain seedlings having a inherited ability to produce stilbene-rich heartwood as mature trees.

The exploitation of the large genetic variation in stilbene concentration could be speeded up by collecting seeds from those seed orchard clones that have been recognised to produce heartwood with high concentration of stilbenes.

(1)Finnish Forest Research Institute, Punkaharju Unit, Finlandiantie 18, FI-58450 Punkaharju, FINLAND, *anni.harju@metla.fi*
(2)Finnish Forest Research Institute, Suonenjoki Unit, Juntintie 154, FI-77600 Suonenjoki, FINLAND
(3) Finnish Forest Research Institute, Oulu Unit, Rakentajantie 3, FI-90014 Oulun yliopisto, FINLAND

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